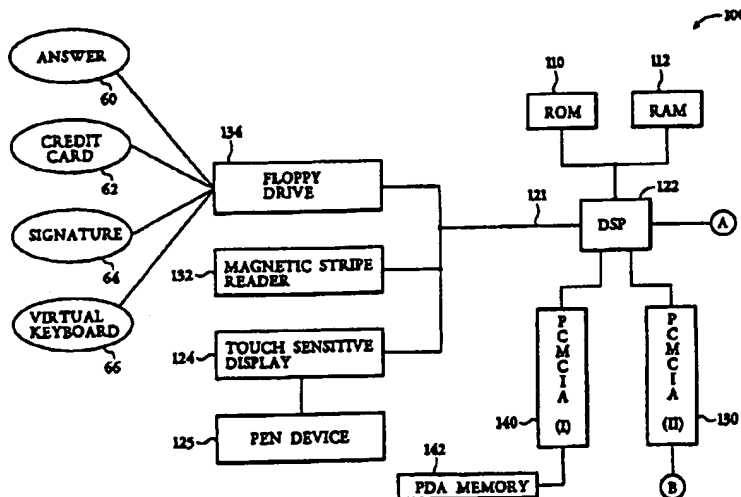




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

| | | |
|---|-----------|--|
| (51) International Patent Classification ⁶ : H04M 11/00 | A1 | (11) International Publication Number: WO 97/05731 |
| | | (43) International Publication Date: 13 February 1997 (13.02.97) |
| <p>(21) International Application Number: PCT/US96/12329</p> <p>(22) International Filing Date: 26 July 1996 (26.07.96)</p> <p>(30) Priority Data: 508,389 31 July 1995 (31.07.95) US</p> <p>(71)(72) Applicants and Inventors: BOULDIN, Eric, W. [US/US]; 2051 Mills Avenue, Menlo Park, CA 94025 (US). LIM, Chee, Wah [MY/MY]; 33-4 Plaza Damansara, Medan Setia 1, Bukit Damansara, 50490 Kuala Lumpur (MY).</p> <p>(74) Agent: SCHNECK, Thomas; P.O. Box 2-E, San Jose, CA 95109-0005 (US).</p> | | <p>(81) Designated States: AU, CA, JP, KR, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).</p> <p>Published <i>With international search report.</i></p> |

(54) Title: MULTIFUNCTION SCREENPHONE



(57) Abstract

A multifunction computerized screenphone (100) provides on-line transaction capability for credit card transactions. A highly reliable signature verification scheme utilizes a verification method (64) based upon the writing dynamics of the making of the signature, thus providing security for the vendor as well as protecting the user. Additional features which enhance the utility of the screenphone include an answering machine (60) which uses digitized voice recordings, which are compressed so that it is practical to use low cost readily available floppy drive technology. PCMCIA ports (130, 140) further enhance the flexibility of the screenphone by allowing the user to attach various external devices, such as PDA memory (142), an external keyboard (66) and a magnetic stripe reader (132) for credit card purchases.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

| | | | | | |
|----|--------------------------|----|---------------------------------------|----|--------------------------|
| AM | Armenia | GB | United Kingdom | MW | Malawi |
| AT | Austria | GE | Georgia | MX | Mexico |
| AU | Australia | GN | Guinea | NE | Niger |
| BB | Barbados | GR | Greece | NL | Netherlands |
| BE | Belgium | HU | Hungary | NO | Norway |
| BF | Burkina Faso | IE | Ireland | NZ | New Zealand |
| BG | Bulgaria | IT | Italy | PL | Poland |
| BJ | Benin | JP | Japan | PT | Portugal |
| BR | Brazil | KE | Kenya | RO | Romania |
| BY | Belarus | KG | Kyrgyzstan | RU | Russian Federation |
| CA | Canada | KP | Democratic People's Republic of Korea | SD | Sudan |
| CF | Central African Republic | KR | Republic of Korea | SE | Sweden |
| CG | Congo | KZ | Kazakhstan | SG | Singapore |
| CH | Switzerland | LI | Liechtenstein | SI | Slovenia |
| CI | Côte d'Ivoire | LK | Sri Lanka | SK | Slovakia |
| CM | Cameroon | LR | Liberia | SN | Senegal |
| CN | China | LT | Lithuania | SZ | Swaziland |
| CS | Czechoslovakia | LU | Luxembourg | TD | Chad |
| CZ | Czech Republic | LV | Latvia | TG | Togo |
| DE | Germany | MC | Monaco | TJ | Tajikistan |
| DK | Denmark | MD | Republic of Moldova | TT | Trinidad and Tobago |
| EE | Estonia | MG | Madagascar | UA | Ukraine |
| ES | Spain | ML | Mali | UG | Uganda |
| FI | Finland | MN | Mongolia | US | United States of America |
| FR | France | MR | Mauritania | UZ | Uzbekistan |
| GA | Gabon | | | VN | Viet Nam |

Description

Multifunction Screenphone

5 Technical Field

The present invention relates generally to telephone sets, and more specifically to a computer-based telephone set.

10 Background of the Invention

Scientists and engineers during the past two decades, and more recently the business community, have used the telephone network as the infrastructure to create what are now being recognized as the building
15 blocks of the information superhighway. A key element is the ability to provide the variety of services that will be needed to attract the consumers, whose acceptance and continued use of the system will be essential to the success of this undertaking.

20 Equipped with a personal computer and a modem to connect to the telephone network, a person can readily get onto the Internet and gain access to a vast world-wide network of information stored on computers that are variously maintained by educational institu-
25 tions, commercial enterprises and even private citizens. Numerous commercial on-line information services, such as America Online, CompuServe, E-World, Prodigy, etc., maintain their own databases, providing access to large stores of information for their registered users. The
30 recently developed World Wide Web offers features not available on the Internet, and has attracted businesses which use the Web as a means of reaching a customer-base that is limited only by the extent of the network. Such access holds great potential, both for businesses desir-
35 ing to reach the consumer and for consumers who benefit from the increased competition.

-2-

In an attempt to take advantage of the opportunities presented by these new consumers, much effort is being expended by electronics companies in the development of pen-based smartphones or screenphones: telephone/computer hybrids with large LCD displays. These devices are being developed to serve as vehicles through which interactive information services can be offered over the phone lines.

In the consumer market, the telephone network has simplified and increased the efficiency for consumers making credit card purchases. Credit card verification at the point of sale used to involve looking up the credit card number in a book to determine whether the number was valid. This was a time consuming procedure that was prone to error and provided limited information. Modern point of sale credit card systems, deployed in the vast majority of retail stores, employ a magnetic stripe reader to obtain credit card information from the magnetic stripe of the purchaser's credit card. Using a telephone data link to the card-issuing institution, the card can be quickly verified and additional information such as available credit can be provided. The use of these credit card readers, however, is not limited to the retail store. For example, U.S. Patent No. 5,311,302 to Berry et al. describes an interactive video terminal for use in a passenger vehicle, such as an airplane. The terminal includes a credit card reader for the payment of ordered items made through the terminal.

Home shopping in the U.S. currently generates \$60 billion in annual revenues. Deploying credit card systems in the home would be beneficial to both the consumer and the retailer. However, losses due to fraudulent credit card purchases outside of home shopping is on the order of 1% per annum. Applying this rate to the home market translates to potential annual losses of \$600 million. The threat of such losses due to credit fraud poses a barrier to the continued use and the potential expansion of home shopping systems.

-3-

What is needed is a computer based telephone, also known as a screenphone or smartphone, that offers convenience of use, a high degree of security and a useful and flexible feature set. At the same time it is desirable to provide a system that offers low production costs so that the savings can be passed on the consumer.

Summary of the Invention

In an embodiment of the present invention, a computer based telephone device includes a base unit and an optionally cordless handset. The base unit includes a computing unit, means for obtaining credit card information and an answering system capable of digitizing and storing incoming voice messages on floppy disks. The computing unit includes system software stored in ROM, a floppy drive, RAM and a display. The computing unit further includes two PCMCIA slots, Type I and II. The display may include a touch sensitive pad, so that user input may be through a pen-based device or a virtual keyboard displayed on the display screen. Alternatively, an external keyboard may be plugged into the PCMCIA type II slot.

The answering system of the present invention provides digital compression of the digitized voice messages so that storage on floppy disks is practical. The PCMCIA slots, however, offer a variety of methods for storing received voice messages other than floppy disks. For example, a PCMCIA type I slot may be used for connecting a PDA type memory card such as flash RAM. The answering system may be a separate machine, or may be implemented partially or entirely in software.

The credit card means may include a magnetic stripe reader, such as those typically used in retail stores, that is capable of communicating along the telephone line. Alternatively, the credit card information may be obtained through software, whereby the user is queried for the pertinent information. A connection to the telephone line enables the computing unit to

-4-

communicate with the credit card company to confirm or deny access to the card.

In order to prevent fraudulent use of credit cards, a signature verification system is included in the present invention. One such verification method is described in U.S. Patent No. 5,202,930 to Livshitz et al. The Livshitz et al. method records the dynamics of the scriber as the signature is made. In this way, a forger who can faithfully reproduce a person's signature is not likely to exhibit the same writing dynamics as those of the owner of the signature, and so can be readily detected.

The present invention is more fully explained by the following drawings and the accompanying description of the best mode contemplated for practicing the invention. Similar elements depicted in the various figures of the drawings are represented by like reference numerals.

Brief Description of the Drawings

Fig. 1 shows a general organization of a telephone of the present invention.

Figs. 2A and 2B illustrates a preferred embodiment of a telephone in accordance with the present invention.

Best Mode of Carrying Out the Invention

A general organization of the computer based telephone of the present invention is shown in Fig. 1. At the heart of the telephone is a processing unit driven by a real time operating system 1, which provides various low level operations such as memory management, I/O management, and graphics primitives. The system includes features 2, 3 such as a main menu for selecting among the various applications, a call status which monitors the progress of call, a directory of phone numbers and addresses, a phone log for making notes during a phone call, an answering machine function, fax and e-mail

-5-

capability, and a calendar/datebook for scheduling appointments and other events. In addition, support utility applications are provided, including a virtual keyboard, a notepad program, a calculator, a world clock, a system set-up utility, a security lock-out utility, a backup program, and a signature capture program. As the technology becomes available and is made affordable, it is contemplated that voice recognition features will be included. Hardware links 4 include a telephone, a modem, a pen-based input screen and PCMCIA slots. The interconnections among these elements and their operation will now be described.

Figs. 2A-2B show an embodiment of the telephone 100 of the present invention. A telecommunications line 10 from the Central Office (CO) of the telephone company provides a telecommunications channel to the user. The telecommunications line 10 is typically a telephone line, known in the industry as a twisted-pair. However, it should be apparent that as advances in the technology are made, affordable access to higher capacity and higher speed networks such as provided by ISDN and optical fiber cable will be possible. Continuing, the telephone line 10 from the CO terminates at a termination point 12 which, for example, may be an RJ-11 telephone jack typically found in most homes. In the case of an ISDN line, the termination point 12 is likely to be an NT1 interface.

The internal wiring 14 is coupled to various telecommunications interface components of the telephone 100. A telephone unit 30 provides the standard telephone functions for the user. The telephone unit 30 is a standard telephone set, and may include a cordless handset. Whether cordless or not, the handset contains a button set for placing calls. Other typical interface components include an analog-to-digital and a digital-to-analog converter 162, 164, a digital tone multifrequency (DTMF) generator 166 and a ring-detect circuit 168. These components 162-168 are coupled to a

-6-

processing unit 122, which in the embodiment of Fig. 2A is shown as a digital signal processing (DSP) unit. A DSP is preferred over a conventional CPU because of the need for high speed digital processing that is inherent in a telephone application. Although a DSP is optimized for such applications, it should be noted that one skilled in the relevant art could easily modify the present invention to incorporate a conventional CPU chip in place of the DSP chip 122.

The DSP chip 122 used in the preferred embodiment of the present invention includes ROM 110 and RAM 112 fabricated within the device itself. Such customized devices help to keep manufacturing costs down. For example, Texas Instruments, Inc. offers a DSP chip having on-board RAM and ROM. The amount of each type of memory can be selected by the system designer. In addition, the DSP chip can be fabricated wherein the ROM is pre-programmed with code supplied by the designer. With respect to the present invention, the ROM 110 contains a real-time operating system (RTOS) and various software primitives that are used by the higher level applications. The RAM 112 serves the same purpose as RAM in a typical computer.

An internal system bus 121 provides a data path between the DSP chip 122 and various system elements, including a floppy drive 134, a touch sensitive display 124 and a magnetic stripe reader 132. In an alternate embodiment, the ROM 110 and RAM 112 is accessed via the system bus, rather than as memory on board the chip. However, such a configuration involves additional components and additional manufacturing steps, which tends to increase overall costs. Nevertheless, such an alternate arrangement is within the scope of the present invention.

The touch sensitive display 124 serves both as an output device and an input device. The display function is based on flat panel technology, and includes, but is not limited to, devices such as two-tone backlit LCD screens, color active matrix devices and flat panel

-7-

CRTs. Active matrix technology is preferred because of the higher resolutions and sharper images that are possible. In addition, color active matrix screens offer very pleasing aesthetics in terms of a user interface.

5 On the other hand, conventional LCD screens are lower cost devices which can decrease manufacturing costs significantly. The decision as to the type of display technology to be used will depend upon the market, and does not impact on the functionality of the telephone.

10 In addition, the touch sensitive display 124 includes a touch sensitive pad for providing user inputs to the telephone. Various technologies are available and known, such as capacitance-sensitive pads, so that a person of ordinary skill can readily practice this aspect
15 of the present invention. Also included is a pen-based input device 125, so that the user can provide input simply by writing upon the touch sensitive device 124.

The floppy drive 134 is a standard 3.5 inch disk drive. The floppy drive serves as the mass storage
20 medium, rather than a typical hard drive. By eliminating the hard drive, manufacturing costs are kept to a minimum. The various user applications are provided to the system through floppies that are read by the floppy drive 134. The particular applications will be more fully
25 describe in the discussion below. Figs. 2A and 2B show that the floppy drive 134 can be attached to the system bus 121 as part of the telephone, or may be an externally provided device that plugs into an external port such as the PCMCIA port 130, which will be described below.

30 It is contemplated that the floppy drive 134 may actually consist of two separate drive units. Such an arrangement would increase storage capacity by dedicating an entire drive to storage, while the applications software is accessed from the second drive. Having a
35 dedicated drive for data storage more readily accommodates the storage demands for digitized voice messages (see below) and portability, allowing the user to put all of their data in one location, namely a removable floppy

-8-

disk. It is further noted that where the floppy drive is provided as an external drive 134, as shown in Fig. 2B, such a device may be a hard disk drive.

5 A magnetic stripe reader 132 is provided to allow the user to make purchases with a credit card. Fig. 2 shows that the magnetic stripe reader can be integrated with the telephone 100, or be attached to the telephone as an external device through a PCMCIA port 130.

10 Two Personal Computer Memory Card International Association (PCMCIA) slots, Type I 140 and Type II 130, allowing the DSP 122 to access externally provided equipment. The PCMCIA Type I slot 140 is compatible with memory cards commonly employed in laptop computers and
15 palmtop organizers, also known as personal data accessories (PDAs). The Type I interface 140 can accommodate memory cards 142 such as flash memory, DRAM and SRAM devices. These memory cards allow the user to carry personalized telephone directories and phone logs from
20 one telephone to another. For example a memory card can be loaded with a telephone directory from a first location and carried by the user to be used at a second location. The PCMCIA Type II slot 130 serves as an interface to a family of useful peripheral devices.
25 These include a keyboard 136 for providing input in addition to the pen-based input of the display 124, a printer 138 to output relevant hardcopy and, as mentioned above, an external floppy drive or a hard disk drive 134.

Referring now to Fig. 2A, the capabilities
30 contemplated for the telephone of the present invention are shown in the software modules 60-66. The software is provided from floppy disks which are read by the floppy drive 134. One such software module implements the functionality of an answering machine, as represented by
35 the answering software module 60. The module provides the functions of a typical answering machine, such as recording an outgoing message, detecting an incoming call, playback of the message when an incoming call is

-9-

received and recording the incoming message. The recorded outgoing message is recorded by a user, digitized and stored on a floppy. The answering software 60 monitors the ring detect circuitry 168 for an incoming
5 call. In an alternate embodiment, the answering software may be interrupt driven, so that the ring detect circuitry interrupts the DSP 122 which then activates the answering software 60. Either approach is possible, and is readily understood by a person of ordinary skill in
10 the relevant arts.

Continuing with the operation of the answering module 60, upon detection of an incoming call, the digitized outgoing message is "played." This involves retrieving the message, converting it to an analog
15 equivalent through the D/A converter 164 and transmitting the resulting analog signal along the telephone line 10. An incoming message is digitized by the A/D converter 162 and stored onto the floppy disk. In order to maintain low production costs for the manufacture of telephones and low operating costs for the user, it is contemplated
20 that the telephone will use industry standard low-cost 3.5" floppy disk drives. In order to make the use of such drives more practical for storing digitized voice files, the answering module 60 of the present invention includes a means for compressing the data. In this way,
25 the storage requirements for the voice files are kept to a minimum. Various compression algorithms are well known and understood by those skilled in the art, and so will not be further discussed. The compressed data files may
30 also be stored to a memory card 142 attached to the PCMCIA Type I port 140.

A credit card software module 62 operates in conjunction with the magnetic stripe reader 132 to provide the user with on-line transaction capability.
35 The magnetic stripe reader provides the software 62 with information from a credit card. An alternate approach is to dispense with the magnetic stripe reader and to query the user directly for the credit card number. This

-10-

approach offers the benefit of not requiring the use of a magnetic stripe reader, thus lowering the cost of the telephone. It is further contemplated that both approaches are incorporated into the telephone, so that user may be queried depending upon whether the magnetic stripe reader has been installed by the user. Continuing, upon receipt of the necessary credit card information, the credit card software 62 initiates a communications link with the appropriate credit card company and proceeds to verify the validity of the information provided on the credit card.

The signature verification software module 64 also participates in the process of making a credit card purchase by providing a mechanism for ensuring that the user of the credit card is who that person purports to be. This involves a third party signature verification service, which stores the signatures of its enrolled members. When the user is ready to conclude a purchase, the user's signature is obtained by signing on the touch sensitive display 124 with the attached pen device. The signature software 64 records a signature using any one of a number of methods. For example, the writing dynamics of a signature as it is written, such as pen speed, pen pressure and pen direction may be measured and recorded. The method disclosed by Livshitz et al. describes one such technique by which writing dynamics may be recorded. The signature software 64, next, sends the recorded signature dynamics to the verification service to confirm the signature by matching them against the user's enrolled signature. Upon verification, a transaction number is transmitted from the service to either the vendor or the credit card company, thus concluding the transaction.

In a further attempt to minimize the cost of the telephone, a virtual keyboard software module 66 is provided. This module utilizes the touch sensitive display 124 as a "virtual" keyboard to allow the user to

-11-

make keyboard entries without having to provide an external keyboard.

The foregoing is a description of the best mode contemplated for practicing the present invention. The
5 illustrations and descriptions are not intended to be limiting, since numerous variations and alternate embodiments will be readily apparent to those of ordinary skill in the relevant arts. For example, as already mentioned, the screenphone of the present invention can easily be
10 adapted to provide access over an ISDN network. Additional applications software provided on floppies would provide the user with features available on such a network. It should also be contemplated that the screenphone of the present invention may be equipped to
15 accept at least a second telephone line. It should be apparent that many alternate embodiments of the present invention are possible without departing from the spirit and the scope of the invention which is distinctly claimed in the following claims.

20

25

30

35

-12-

Claims

1. A computer based telephone device for use with a telecommunications channel comprising:

5 a telephone handset having a speaker and a microphone, and circuitry for communication with said telecommunications channel;

 a video terminal including
 a display device,
10 input means for obtaining user-provided information,

 first memory means, coupled to said input means, for storing said user-provided information,
 second memory means for storing
15 pre-defined information,

 a processing device coupled to each of said input means, first memory means, and second memory means, and
 signaling means, coupled to said
20 processing device and to said telecommunications channel, for originating calls in response to said user-provided information and for communicating along said telecommunications channel,

 said display device having a data path to
25 each of said first and second memory means, thereby allowing said information to be displayed;

 a credit card means, coupled to said telecommunications channel, for transmitting and receiving credit card information therealong; and

30 an automated answering means, coupled to said telecommunications channel, for unattended receiving of incoming calls including means for digitizing messages from said telecommunications channel and for compressing said digitized messages.

35

-14-

8. The telephone device of claim 1 wherein said automated answering means further includes processing means for transmitting a pre-defined message along said telecommunications channel and for receiving messages therefrom; and including third memory means, coupled to said processing means, for storing said digitized messages.

9. The telephone device of claim 8 wherein said third memory means comprises at least one removable disk.

10. The telephone device of claim 8 wherein said third memory means is one of a memory card and a floppy disk.

11. The telephone device of claim 1 further comprising means for verifying a signature, including a pen-based input device and means for recording the user's writing dynamics; said pen-based input device being coupled to said means for recording so that as said signature of the user is written, said writing dynamics are recorded; said means for verifying further including a connection to said telecommunications channel so that said writing dynamics may be verified remotely.

12. The telephone device of claim 1 further including a base unit that houses said display device, input means, first and second memory means, second coupling means, means for transmitting and means for receiving; and wherein said telephone handset is cordless.

13. The telephone device of claim 12 wherein said cordless telephone handset includes said credit card means.

-15-

14. A computerized screenphone for communicating data and voice information over a telephone channel comprising:

5 a bus means for conveying analog and digital signals;

a data processing device having a flat-panel display screen, an input means, a PCMCIA Type I slot, a PCMCIA Type II slot and an internal floppy disk drive, said data processing device being coupled to said bus means;

10

a magnetic stripe card reader coupled to said bus means;

an answering unit coupled to said bus means, and having means for digitizing said voice information and for compressing said digitized voice information;

15

means for verifying a signature, having means for recording writing dynamics during the making of a signature by the user; and

circuitry for connection to said telephone channel being coupled to said bus means, thereby providing communication access between said telephone channel and each of said data processing device, magnetic stripe card reader and answering unit;

20

said data processing device having means for accessing said compressed voice information from said answering unit and for storing said compressed voice information onto a storage medium;

25

said data processing device further having means for accessing said writing dynamics and for transmitting said writing dynamics over said telephone line so that said writing dynamics can be verified at a remote location.

30

35

-16-

15. The computerized screenphone of claim 14 wherein said storage medium is one of a removable floppy disk and a memory card having a PCMCIA Type I connector; and said input means includes a touch sensitive pad having a pen device, said pad being operatively associated with said flat-panel display, said input means further including an optional keyboard having a PCMCIA Type II connector.
16. The computerized screenphone of claim 14 wherein said data processing device is a digital signal processor.
17. A screenphone for connection to a telecommunications network, said screenphone comprising:
- a base unit; and
 - a handset unit;
- said base unit and said handset unit having respectively first and second wireless means for wireless communication therebetween, whereby said base unit can be cordlessly and remotely operated from said handset unit;
- said base unit including a computer, said computer having a storage medium and means for communicating with said network, said computer being coupled to said first wireless means;
- said base unit further including a pen-based display device and means for acquiring user inputs, each being operatively coupled to said computer;
- said computer including means for acquiring credit card information from the user, means for transmitting said acquired credit card information to said network and means for receiving credit card information from said network;

-17-

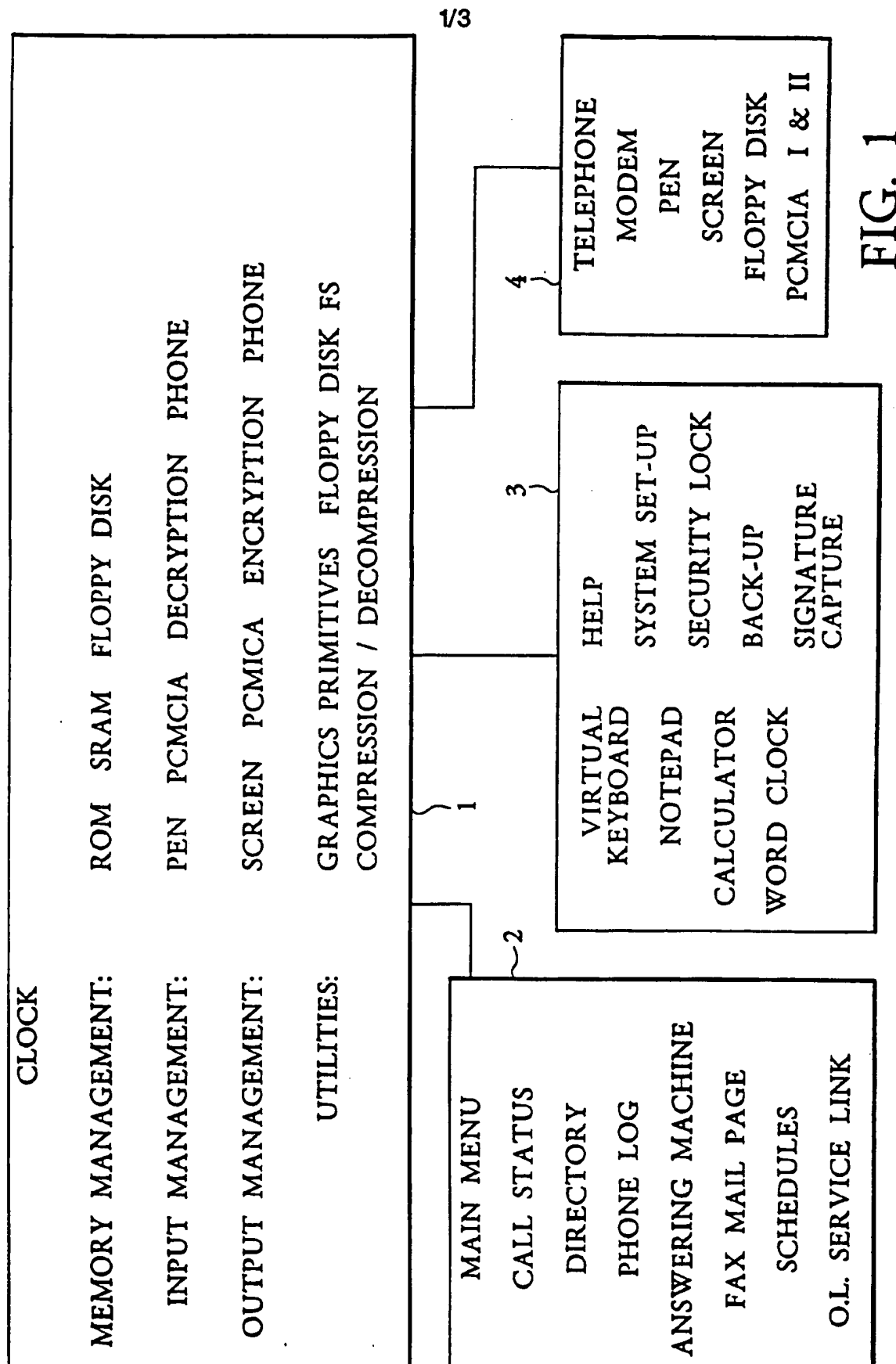
said computer further including means for automatic unattended answering of incoming calls, including means for detecting an incoming call from said network, means for transmitting a pre-recorded message to said network, means for receiving incoming messages from said network, means for digitizing and compressing said incoming messages, and means for storing said messages on said storage medium;

said computer further including means for verifying a signature, including means for recording writing dynamics during the process of signature making by the user; and means for communicating said writing dynamics to said network, whereby said writing dynamics can be verified at a remote location.

18. The screenphone of claim 17 wherein said computer further includes a digital signal processor, a PCMCIA Type I and a PCMCIA Type II interface.

19. The screenphone of claim 18 wherein said means for acquiring user input is an input device having a PCMCIA Type II connector.

20. The screenphone of claim 18 wherein said storage medium is one of a removable disk and a memory card having a PCMCIA Type I connector.



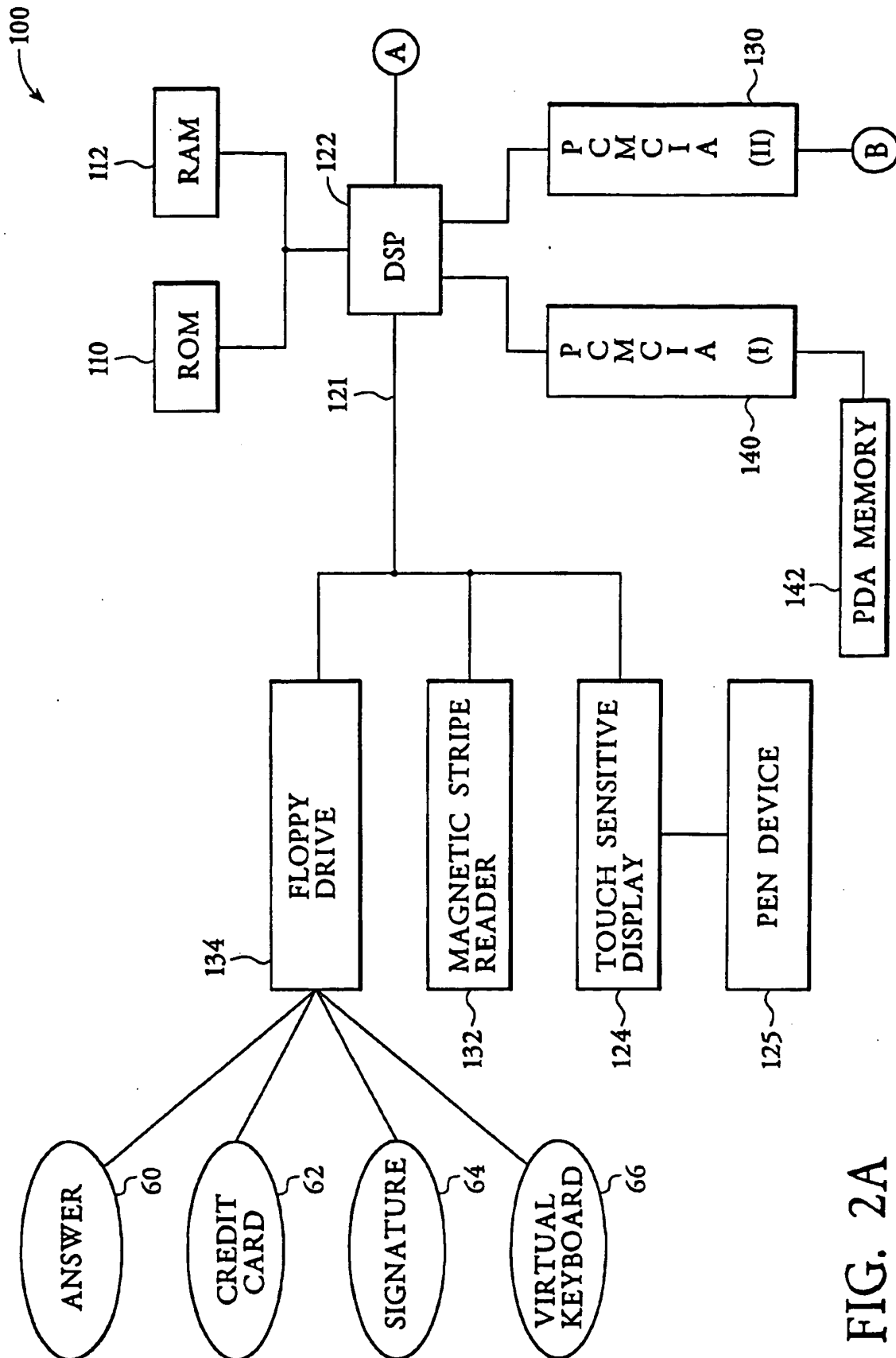


FIG. 2A

3/3

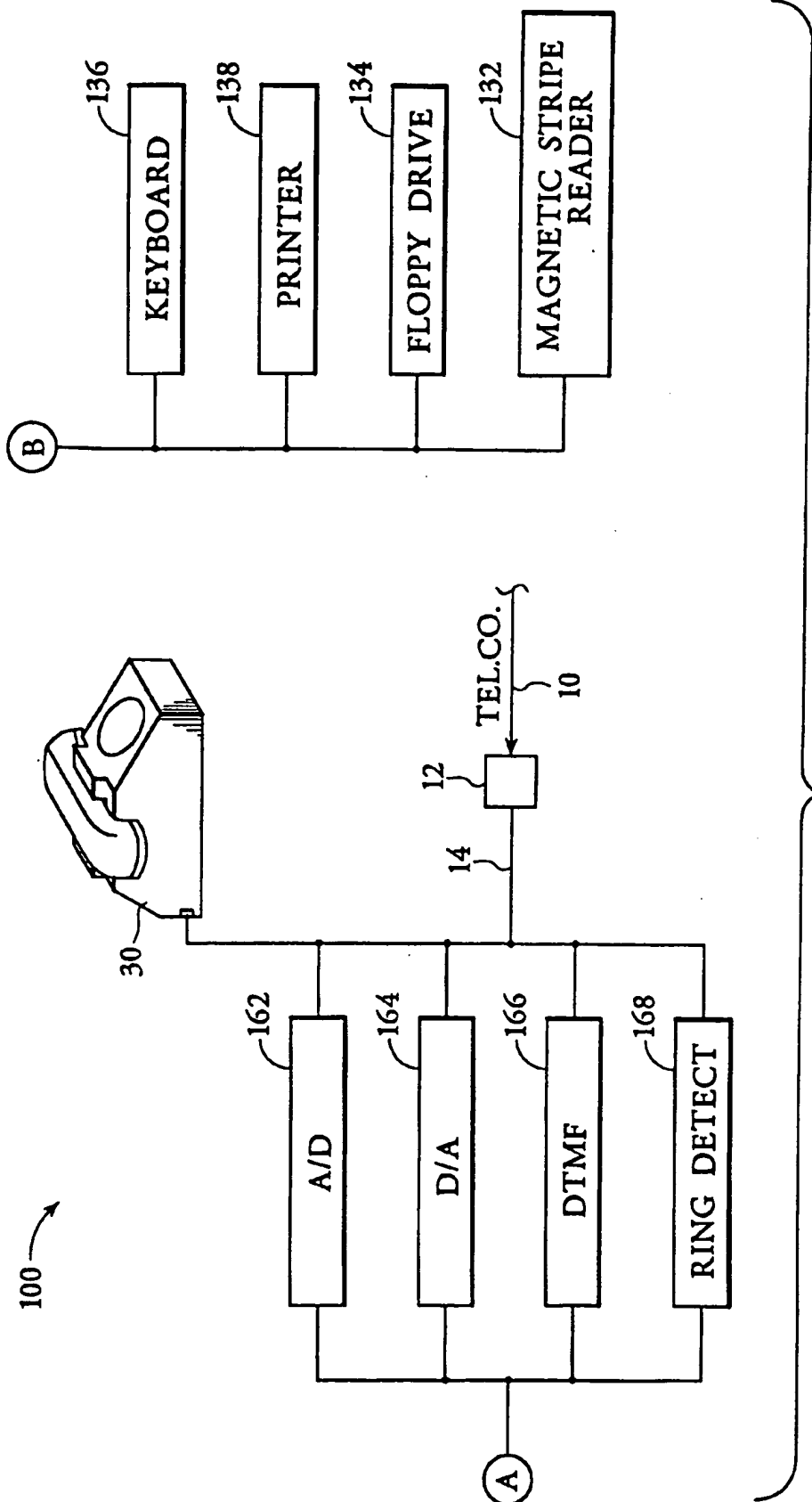


FIG. 2B

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US96/12329

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :H04M 11/00

US CL :379/91

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 379/91, 96, 95, 93, 58, 59

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|--|-----------------------|
| Y, P | US, A, 5,521,966 (FRIEDES ET AL.) 28 MAY 1996, see Fig. 1; col. 4, lines 45-46. | 1-20 |
| Y, P | US, A, 5,485,505 (NORMAN ET AL.) 16 JANUARY 1996, see col. 6, lines 20-39; col. 10, lines 54+. | 2, 11, 14-20 |
| A | US, A, 5,485,370 (MOSS ET AL.) 16 JANUARY 1996, see Abstract. | 1-20 |
| A | US, A, 5,266,782 (ALANARA ET AL.) 30 NOVEMBER 1993, see Abstract. | 1-20 |

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

| | | |
|---|-----|--|
| * Special categories of cited documents: | *T | later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention |
| *A* document defining the general state of the art which is not considered to be part of particular relevance | *X* | document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone |
| *E* earlier document published on or after the international filing date | *Y* | document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art |
| *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) | *Z* | document member of the same patent family |
| *O* document referring to an oral disclosure, use, exhibition or other means | | |
| *P* document published prior to the international filing date but later than the priority date claimed | | |

Date of the actual completion of the international search

08 SEPTEMBER 1996

Date of mailing of the international search report

27 SEP 1996

Name and mailing address of the ISA/US
Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231

Facsimile No. (703) 305-3230

Authorized officer

STELLA WOO

Telephone No. (703) 305-4395

Form PCT/ISA/210 (second sheet)(July 1992)*